

REMARKS

This Amendment is being filed in response to the Office Action having a mailing date of July 16, 2003. Independent claims 1, 5, and 9 are amended as shown. More specifically, these claims are amended to more precisely recite distinctive features therein. New claims 14-19 are added. No new matter has been added. With this amendment, claims 1-19 are pending in the application.

In the Office Action, claims 1, 5, 9, and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee (article entitled "Model Based Face Reconstruction For Animation") in view of Wiskott (article entitled "Face Recognition By Elastic Bunch Graph Matching"). Claims 2-4, 6-8, and 10-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of Wiskott and in further view of Thalmann (article entitled "Face To Virtual Face"). For the reasons set forth below, the applicants respectfully disagree with these rejections, and request that the pending claims be allowed.

Independent claim 1 as originally filed recited "automatically positioning nodes at feature locations on the front head image and the side image" (emphasis added). On page 2, paragraph 2 of the Office Action, the Examiner has cited Lee as disclosing this feature, by stating that Lee discloses a technique to "provide automatic feature points extraction method... we consider... points such as eyes, nose, lips, eyebrows and ears as feature points..." (citing page 6, paragraph 1, Figure 1 of Lee).

This is an incorrect reading of Lee as Lee does not report or reference any methodology as to the automatic positioning of "nodes." Rather, Lee discloses use of "structured snakes" to extract contours, not feature points. Specifically Lee states "we consider hair outline and face outline and some interior points such as eyes, nose, lips, eyebrows and ears as feature points.... We use a structured snake for it which has functionality to keep the structure of contours" (emphasis added). Simply stated, Lee uses the various outlines of an image in order to generate an avatar. Snakes are used to find curves in an image (such as the outline of a nose or hairline on a forehead) where the gradient of the pixel intensity is important and where the outlines between different facial features can be readily identified. However, in the inside of the

face, it is impractical to use the structured snakes tool of Lee to define a feature location. Furthermore, snakes will fail in the presence of adverse lighting conditions.

In contrast, one embodiment of the applicants' invention uses multiple points or nodes positioned within feature locations on the front head image and the side head image. *See, e.g.,* Figures 2 and 4 of the present application. Thus, an embodiment of the invention places nodes within certain facial features (such as on the nose or the cheek), rather than relying on snake structures that follow discernable edges of an image. Furthermore with Lee, an entire eye (for example) is defined/used as a sole "feature point." However, detecting only that there is an eye on the picture (for example) is not sufficient to allow the use of artificial eyes with a realistic-looking cut-out of the eye. Rather, an embodiment of the present invention can use multiple points within a feature location in order to provide a better avatar image—the feature itself does not define a solitary insufficient "feature point," as is the case with Lee. In order to more precisely recite this distinction, claim 1 is amended to recite automatically positioning nodes within feature locations. This amendment clarifies that the nodes (multiple nodes) may be placed within a feature location (as well as along its edges), rather than being restricted to solely its edges and external contours, as is the case with Lee.

On page 2, paragraph 2 of the present Office Action, the Examiner has acknowledged that Lee does not explicitly disclose "automatically finding head feature locations on the front head image and the side head image using elastic bunch graph matching," as recited in claim 1. The Examiner has cited Wiskott as disclosing this feature with a "graph... representing a face consists of nodes... the nodes are located at facial landmarks... graphs for new images can be generated automatically by elastic bunch graph matching..." (*see, e.g.,* page 130, column 1, full paragraph 2, page 131, column 1, Figure 1 of Wiskott). The Examiner further stated that it would have been obvious to a person of ordinary skill in the art to modify the method of Lee by automatically finding head features locations using elastic bunch graph matching, such as disclosed by Wiskott. The applicants respectfully disagree with this conclusion. There is no such suggestion or motivation to a person skilled in the art. For example, as pointed out by Thalmann in paragraph II.C: "The task of automatically and faithfully tracking and recognizing facial dynamics without invasive markers or special lighting

conditions, however, remains an active exploratory area of research.” Wiskott discloses results based on simplified bunch graphs, and it is not obvious from Wiskott that it is feasible to locate with sufficient precision the set of landmarks to be used.

Even if Wiskott is combined with Lee, the resulting combination would still not provide the features recited in claim 1. Wiskott presents results for automatically “recognizing people.” This technique does not necessarily imply that the method of Wiskott can be used to “find” generic features in generic faces with sufficient accuracy for purposes of creating an avatar. The technique of Wiskott identifies known people in a database with a simplified bunch graph with a single point in the eye and the mouth and so forth.

It is not obvious from Wiskott that the position of the extracted features using Gabor wavelets is sufficiently accurate to allow the system of Wiskott to work automatically and correctly for the purpose of creating avatars. Wiskott does not use geometrical information in recognizing faces. The fact that Wiskott does not use the position of the points implies that his technique is not sufficiently accurate to create avatars. For creating avatars, an embodiment of the applicants’ invention (and in contrast to Wiskott), uses geometrical information once the features are extracted (*e.g.*, an embodiment. uses the position of the features only to build both the model and the texture for the avatar). Wiskott states, “Grid distortions are not taken into account. ... A person is recognized correctly if the correct model yields the highest graph similarity...”. Here “grid” is the graph, “distortions” refer to the fact that a standard (average) graph is distorted to fit the features of a specific individual; “highest graph similarity” refers to the fact that only the similarity function presented in the Wiskott article is used: that similarity (paragraph 2.1 of the article) uses only the radiometric information (pixel intensity distribution around the features) by taking into account the amplitude of the response to the Gabor kernels.

Indeed, it is wrongly assumed that the computer vision technique presented by Wiskott would work without substantial improvement to accurately locate features in the front and side image of a face. Wiskott does not report any such results, as it was unclear at the time of its publication that it would be feasible because of possible occlusions (*e.g.*, ears may be occluded partially or completely with hairs, thereby removing one of the main features that allow

the finding of sides of faces in an image), the limited number of facial landmarks usable in an image of the front and side of a face, and the difficulty of working with the outline of the face.

Accordingly, based on the amendment to claim 1 and the fact that there is no motivation to combine Wiskott with Lee, claim 1 is allowable over the cited references.

Independent claim 5 recites a means for automatically finding head feature locations on the front head image and the side head image using elastic bunch graph matching. As described above, there is no motivation to combine Wiskott with Lee to provide this feature, and therefore independent claim 5 is allowable over the references. Independent claim 5 is amended to recite a means for automatically positioning nodes within feature locations. This feature is not disclosed, taught, or suggested by any of the references. For example, Lee uses a technique where snake structures are used to delineate outlines of feature locations, and cannot and are not used to automatically position nodes within the feature locations themselves. Accordingly, amended claim 5 is allowable over the cited references.

Independent claim 9 recites "automatically finding head feature locations using image analysis based on wavelet component values generated from wavelet transformations...." As described above, there is no motivation or suggestion to combine the teachings of Wiskott with Lee, and therefore claim 9 is allowable over these references. Moreover, independent claim 9 is further amended to recite automatically positioning nodes within feature locations. This feature is not disclosed, taught, or suggested by any of the references. For instance, Lee discloses use of snake structures to delineate the outline and exterior edges of facial features, and does not automatically position nodes within feature locations as claimed in amended claim 9. Accordingly, amended claim 9 is further allowable over the cited references.

With regards to dependent claim 2, the Examiner has cited Thalmann as disclosing "applying an animation transform based on the corrected node positions for the neutral face." More specifically, the Examiner has cited page 876, column 2, paragraph 1 through page 877, column 1, and Figure 5 of Thalmann to substantiate this rejection. Thalmann uses minimum perceptible actions (MPAs) for its mapping.

An embodiment of the applicants' invention does not use MPAs, and instead maps node positions to "key-frames" using interpolation. "Key frame" can be likened to "an

avatar mesh associated with a facial expression,” such as described on page 6, paragraph 0023 of the present application. Thalmann uses “regions of muscular activity” (*see, e.g.*, paragraph III.B of Thalmann) and does not disclose the manner in which the dynamic behavior of the regions is adjusted from the generic model to a specific avatar. Paragraphs 0020, 0022, and 0023 (for example) of the present application clearly state that key frames are used and the key frames are adjusted using linear regression based on how the generic modeled neutral face is deformed. This is in sharp contrast to the technique presented by Thalmann. New claim 14 is a method claim that explicitly recites the mapping of sense facial features to corresponding avatar meshes using linear regression. Claims 2 and 14 are allowable over Thalmann and the other cited references.

In rejecting dependent claim 3, the Examiner stated that “Thalmann discloses applying the animation transform to expression face avatar meshes for generating the avatar” (emphasis ours). This is an incorrect reading of Thalmann. The applicants respectfully submit that the Examiner has confused two concepts: 1) creation of the animation data, and 2) animation of the model. Thalmann is actually referring to the animation of the model (concept 2), and not about the creation of the animation data for the model (concept 1). The present disclosure and dependent claim 3 are referring to the creation of the animation data (concept 1). For example, the applicants’ disclosure speaks about the manner of creation of a model that can be animated (key-framed model), which can be created by mapping sensed expressions (*see, e.g.*, paragraph 0022) or automatically adapting the key-frames (*see, e.g.*, paragraph 0022). That is, the present disclosure further discloses in paragraph 0020 how to map facial expressions to create key-frames. Tracking data are in turn used to interpolate key-frames in the avatar to achieve animation. In paragraphs 0022 and 0023 of the present application, the disclosure describes how key-frames can also be automatically produced using the deformations between the generic neutral model and the deformed model that fits the front and side images (*see, e.g.*, equations 1 and 2 of the present application).

Thalmann, in contrast, uses a direct mapping between sensed animation points and avatar animation in order to animate the avatar. The applicants’ embodiment does not relate to the manner in which a model is animated: once the key-frames are available, key-frame

interpolation is a standard computer graphics technique that can be used for animation. In short, the applicants' embodiments describe the manner in which to create an avatar that can be animated, rather than mapping track node positions to a model for the purpose of animating the model, which is what Thalmann involves.

Accordingly, dependent claim 3 in its present form is believed to be allowable over Thalmann, since it recites "for generating the avatar," rather than something like "for animating the avatar."

Similarly, dependent claims 7 and 11 recite the application of the animation transform for generating the avatar. Therefore, these claims are also allowable over the cited references, since Thalmann does not involve generation of an avatar, but rather animation of an avatar.

New dependent claims 15 and 16 are also added. These dependent claims recite the use of the linear regression technique that is not disclosed, taught, or suggested by any of the references. These new dependent claims are allowable. New dependent claims 17-19 recite the distinctive feature of using geometric information to create an avatar, such as discussed above and disclosed in the present application.

The applicants note for the Examiner that they have changed attorneys. All future correspondence should be directed to Dennis M. de Guzman (Registration No. 41,702) at the Seed Intellectual Property Law Group PLLC (Customer No. 00500) at the contact information below:

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The applicants will be filing formal Powers of Attorney subsequent to the mailing date of this Amendment. It is kindly requested that the Examiner double-check the file prior to the mailing of the next communication, so as to ensure that the next communication is mailed to the above-identified address. If there is a discrepancy between the address of record at the PTO

and the above-identified address at the time of mailing of the next communication, the Examiner is kindly requested to contact the undersigned attorney to verify the proper mailing address.

Overall, none of the references singly or in any motivated combination disclose, teach, or suggest what is recited in the independent claims. Thus, given the above amendments and accompanying remarks, the independent claims are now in condition for allowance. The dependent claims that depend directly or indirectly on these independent claims are likewise allowable based on at least the same reasons and based on the recitations contained in each dependent claim.

If the undersigned attorney has overlooked a teaching in any of the cited references that is relevant to the allowability of the claims, the Examiner is requested to specifically point out where such teaching may be found. Further, if there are any informalities or questions that can be addressed via telephone, the Examiner is encouraged to contact the undersigned attorney at (206) 622-4900.

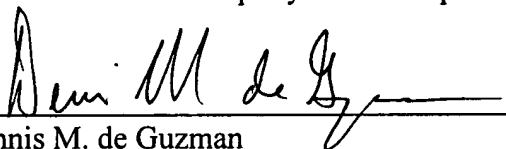
The applicants also note that there is an error in title of the application as printed on the Official Filing Receipt. The correct title (as indicated in the originally filed application and in the executed declaration) is: METHOD AND SYSTEM **FOR** GENERATING AN AVATAR ANIMATION TRANSFORM USING A NEUTRAL FACE IMAGE. It is requested that the file wrapper and/or filing receipt be corrected to ensure that the correct title prints on the issued patent.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable.
Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

SEED Intellectual Property Law Group PLLC

A handwritten signature in dark ink, appearing to read "Dennis M. de Guzman", is written over a horizontal line.

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